DOCUMENT-IDENTIFIER: US 5635419 A
TITLE: Porous silicon trench and capacitor structures

---------- KWIC ---------

DEPR:
Porous silicon is produced utilizing anodic etching. Anodic etching is performed by submerging the silicon wafer or other silicon substrate in a container of electrolytic solution of hydrofluoric acid and subjecting the wafer to an electrolytic current. The electrolytic current is generated between two electrodes, an anode and a cathode. The wafer or other silicon substrate comprises the anode. The container, or a platinum electrode immersed in the electrolytic solution parallel to the wafer or substrate, comprises the cathode. Typically, anodizing creates a porous surface on the material employed as the anode. The resulting microstructure of the porous surface is a series of elongated pores or depressions, formed by the anodic conversion of the silicon in the hydrofluoric acid. Anodization is typically conducted with a current density range of 10 mA/cm.sup.2 to 100 mA/cm.sup.2 in a hydrofluoric acid solution having a concentration range between 10 and 60 percent by weight. The anodization current and concentration of hydrofluoric acid solution are typically chosen to produce a porous film density of substantially 45 percent. Porous film density is equal to the percent of weight loss (for a given volume of material anodized) experienced during anodization.

DEPR:
The high conductivity regions 20 and 12 are then anodized in a solution which converts the silicon in the regions to a porous silicon structure. This can be conveniently achieved by anodizing the structure in an aqueous HF solution at a current density sufficient to achieve porosity. In general, the anodizing solution should contain HF in an amount greater than ten percent, more particularly from 12 to 25 percent. The most desirable solution concentration for a specific application will depend on device configuration, dopant concentration, solution temperature, current density, illumination, etc. The substrate 10 is made the anode in an HF solution 22 through contact 21 as shown in FIG. 14. A suitable plate 24 acts as the cathode. After the anodization step illustrated in FIG. 5 is complete, the average porosity of the porous silicon should be greater than 40 percent, more preferably in the range of 50 to 80 percent. Most preferably, the porosity is on the order of 56 percent. This porosity will result in dense Si0.sub.2, after oxidation, without introducing significant internal stresses. The exact porosity of the silicon can be adjusted by varying the HF concentration of the anodizing solution, the illumination, the temperature of the solution, the dopant concentration of the silicon regions, and the current density. If the silicon porosity is significantly greater than 56 percent, a porous Si0.sub.2 is obtained. If the porosity is significantly less than 56 percent, stressed silicon may result due to the volume expansion resulting from silicon being oxidized to Si0.sub.2. The current density for ordinary, practical conditions is in the range of 20 to 60 milliamperes per square cm.

DOCUMENT-IDENTIFIER: US 4016017 A
TITLE: Integrated circuit isolation structure and method for producing the isolation structure

---------- KWIC ---------

DEPR:
The high conductivity region 14 is then anodized in a solution which converts the silicon in the regions to a porous silicon structure. This can be conveniently achieved by anodizing the structure in an aqueous HF solution at a current density sufficient to achieve porosity. In general, the anodizing solution should contain HF in an amount greater than 10 percent, more particularly from 12 to 25 percent. The most desirable solution concentration for a specific application will depend on device configuration, dopant concentration, solution temperature, current density, illumination, etc. After the anodization step, the resulting structure as illustrated in FIG. 2 is complete, the average porosity of the porous silicon should be greater than 40 percent, more preferably in the range of 45 to 80 percent. Most preferably, the porosity is less than about 60 percent. The exact porosity of the silicon can be adjusted by varying the HF concentration of the anodizing solution, the illumination, the temperature of the solution, the dopant concentration of the silicon regions, and the current density. If the silicon porosity is significantly greater than 60 percent (for example, 85 percent), a treatment of 970.degree. C in steam followed by 1200.degree. C for 15 minutes steam would lead to a non-completely densified oxide. If the silicon porosity is significantly less than about 45 percent, a non-complete